

End-Term Examination, November – December, 2024 (Backlog)

Programme : B.Tech. **Year/Semester** : 2nd / 4th
Course Name : Strength of Material & Analysis **Course Code** : ME1105
Time : 2:30 Hours **Maximum Marks** : 30

Important Notes:

- The candidates, before starting to write the solutions, should check the question paper for any discrepancies and also ensure that they have delivered the question paper with the correct course code.
- All symbols, unless stated, have their usual meaning in the context of the course.
- If any additional data is required, *assume suitably and state clearly*.

Q. No.	Question	Marks/ CO(s)
Q 1.	A steel rod of diameter 12 mm and length 3 meters is subjected to a tensile force of 50 kN. The tensile strength of the material is 400 MPa and the yield strength is 250 MPa. - Calculate the stress in the rod due to the applied load. - Determine the factor of safety using the tensile strength and the yield strength. Explain the stress-strain diagram for a ductile material. Describe the different regions of the diagram, including the proportional limit, elastic limit, yield point, ultimate tensile strength, and fracture point.	2+2+2 ME1105.1
Q 2.	At a point in a material, the state of stress is given by the following normal and shear stresses: $\sigma_x = 50$ MPA (tensile stress in the x-direction) $\sigma_y = 30$ MPA (compressive stress in the y-direction) $\tau_{xy} = 20$ MPA (shear stress in the x-y plane) - Determine the principal stresses at the point. - Find the angle at which the maximum normal stress occurs. - Draw Mohr's circle and identify the maximum and minimum shear stresses.	2+2+2 ME1105.2 ME1105.3

Q 3.	A simply supported beam having 6 meters length is subjected to a point load of 10 kN at its centre. Determine the followings: - Shear force and bending moment at the left support ($x = 0$ m) - Shear force and bending moment at the point of load ($x = 3$ m) - Draw shear force and bending moment diagrams for the beam.	2+2+2 ME1105.3
Q 4.	A solid circular shaft of diameter 150 mm is subjected to a torque of 2000 Nm and a bending moment of 10 kNm. The shaft is made of steel with a yield stress of 250 MPa and a shear modulus $G = 80 \times 10^9$ N/m². - Determine the maximum bending stress. - Calculate shear stress at the surface of the shaft. - Find whether shaft will fail or not using von Mises criterion (Maximum Distortion Energy Theory).	2+2+2 ME1105.3 ME1105.4
Q 5.	A vertical column of length 3 meters is made of steel with a Young's modulus of 2×10^{11} N/m² and has a moment of inertia of the cross-section 5×10^{-6} m⁴. The column has a circular cross-section with a diameter of 50 mm. Determine the critical buckling load for the column with the following boundary conditions: - Both ends hinged (pinned-pinned). - One end fixed and the other end hinged. - Both ends fixed (fixed-fixed).	2+2+2 ME1105.5